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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,517	01/18/2005	Ingrid Maja Guenther	TS8577US	2025
7590		03/23/2009	EXAMINER	
Jennifer D Adamson		PRICE, CARL D		
Shell Oil Company		ART UNIT		
Intellectual Property		PAPER NUMBER		
PO Box 2463		3749		
Houston, TX 77252-2463		MAIL DATE		
		DELIVERY MODE		
		03/23/2009		
		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/521,517	Applicant(s) GUENTHER ET AL.	
	Examiner Carl D. Price	Art Unit 3749	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12/30/2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22-44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims **22-44** have been considered but are moot in view of the new ground(s) of rejection.

Applicant's argument that the prior art relied on in the previous office action fail to show, disclose and/or teach certain aspects of applicant's invention recited in the claims filed on **06/24/2008**, applicant's claims to include at least the following:

22. (Previously Presented)

A process for reducing emissions operating a yellow flame burner, the process comprising:

feeding to a yellow flame burner adapted to burn petroleum derived gas oil one or more liquid Fischer-Tropsch product comprising iso-paraffins and normal paraffins, the one or more liquid Fischer-Tropsch product having a density of between 0.65 and 0.8 g/cm³ at 15 °C;

burning the one or more liquid Fischer-Tropsch product using the yellow flame burner under conditions comprising a value of lambda of from about 1 to about 2 producing improved flue gas comprising less carbon monoxide and less NOx than flue gas produced burning only petroleum derived gas oil; and,

performing one or more procedure selected from the group consisting of heating water by indirect heat exchange with the improved flue gas in one or more boiler and heating space directly with the improved flue gas.

Regard to applicant's claimed invention the following observations are made with regard to information concerning applicant's disclosed understanding of the prior at the time of the invention:

With regard to "yellow flame" combustion and burners applicant discloses the following:

"Blue flame burners are known to have a desirable low NOx emission as compared to yellow flame burners. Nevertheless **yellow flame burners are still widely applied** and there is thus a need to reduce the NOx of such yellow flame burners" (Page 2. lines 9-13)

"The **operating conditions** of the **yellow flame burner** may be **the same** as the operating **conditions used for the state of the art fuels**. The proportion of air in excess of that required for stoichiometric combustion is known as the excess air ratio or "**lambda**", which

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is defined as the ratio of total air available for combustion to that required to burn all of the fuel. **Preferably the lambda is between 1 and 2 and more preferably between 1 and 1.6.**

Applicants found that by using a Fischer-Tropsch derived fuel a very low lambda of between 1.05 and 1.2 could be applied without large emissions of carbon monoxide as would be the case when Industrial Gas Oil would be used.” (Page 3, lines 11-22).”

With regard to the Fischer-Tropsch derived fuel applicant discloses the following:

“The Fischer-Tropsch derived fuel will comprise a Fischer-Tropsch product which may be any fraction of the middle distillate fuel range, which can be isolated from the (hydrocracked) Fischer-Tropsch synthesis product. **Typical fractions will boil in the naphtha, kerosene or gas oil range.** Preferably a Fischer-Tropsch product in the kerosene or gas oil range is used because these fractions are easier to handle in for example domestic environments. Such products will suitably comprise a fraction larger than 90 wt% which boils between 160 and 400 °C, preferably to about 370 °C. **Examples of Fischer-Tropsch derived kerosene and gas oils** are described in EP-A-583836, WO-A-9714768, WO-A-9714769, WO-A-011116/ WO-A-011117, WO-A-0183406, WO-A-0183648, WO-A-0183647, WO-A-0183641, WO-A-0020535, WO-A-0020534, EP-A-II01813, US-A-5766274, US-A-5378348, US-A-5888376 and US-A-6204426.

“The Fischer-Tropsch derived product will suitably contain more than 80 wt%, preferably more than 90 wt% iso and normal paraffins and less than 1 wt% aromatics, the 10 balance being naphthenics compounds. The content of sulphur and nitrogen will be very low and normally below the detection limits for such compounds. **This low content of these elements is due to the specific process wherein the Fischer-Tropsch reaction is performed.** The content of sulphur will therefore be below 5 ppm and the content of nitrogen will be below 1 ppm. **As a result of the low contents of aromatics and naphthenics compounds the density of the Fischer-Tropsch product** will be lower than the conventional mineral derived fuels. **The density will be between 0.65 and 0.8 g/cm³ at 15 °C.** The fuel used in the process of the present invention may also comprise fuel fractions other than the Fischer-Tropsch derived fuel components. Examples of such components may be the **kerosene or gas oil** fractions as obtained in traditional refinery processes, which upgrade crude petroleum feedstock to useful products. Preferred **non-Fischer-Tropsch fuel fractions** are the ultra low sulphur (e.g. less than 50 ppm sulphur) **kerosene or diesel fractions, which are currently on the market.** Optionally non-mineral oil based fuels, such as bio-fuels, may also be present in the fuel composition. The content of the Fischer-Tropsch derived product in the fuel will be preferably be above 40 wt%, more preferably above 60 wt% and most preferably above 80 wt%. It should be understood that the content of such, currently less available, **Fischer-Tropsch products will be optimised,** wherein **pricing of the total fuel will be balanced with the advantages of the present invention.** For some applications fuels fully based on a Fischer-Tropsch product plus optionally some additives may be advantageously used.

In summary, applicant's own disclosure acknowledges the following with regard to the prior art:

Yellow flame burners are widely applied in the art and there is thus a need to reduce the NO_x of such yellow flame burners.

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Operating conditions of the yellow flame burner of the present invention *may be the same as the operating conditions used for the state of the art fuels. Preferably the lambda is between 1 and 2 and more preferably between 1 and 1.6.*

EP-A-583836 represents an example of a known Fischer-Tropsch derived kerosene and gas oils disclosed as suitable by applicant.

EP-A-583836 discloses Fischer-Tropsch synthesis are known to prepare hydrocarbons suitable for use as fuels such as middle fuels including one or more kerosene fractions boiling in the range of from 120 to 300 °C and one or more gasoil fractions boiling in the range of from 170 to 370 °C.:

The preparation of hydrocarbons from a mixture comprising carbon monoxide and hydrogen by contacting the mixture with a suitable synthesis catalyst at elevated temperatures and pressures is known in the art as the Fischer-Tropsch synthesis. **It is known in the art to apply Fischer-Tropsch synthesis processes in the preparation of a range of principally aliphatic hydrocarbons having a wide range of molecular weights.** Of particular interest, however, **is the use of the Fischer-Tropsch synthesis to prepare hydrocarbons suitable for use as fuels,** for example hydrocarbons having boiling points within the boiling point ranges of naphtha and **the middle distillates.**

For the purposes of this specification, the term "**middle distillates**" as used herein is to be taken as a reference to hydrocarbons or hydrocarbon mixtures having a boiling point or boiling point range substantially corresponding to that of the **kerosene** and **gasoil** fractions obtained during the conventional atmospheric distillation of crude oil. The term "naphtha" as used herein is a reference to hydrocarbons or hydrocarbon mixtures having a boiling point or boiling point range substantially corresponding to that of the naphtha (sometimes referred to as the gasoline) fractions obtained during the conventional atmospheric distillation of crude oil. In such a distillation, the following fractions are consecutively recovered from the crude oil: one or more naphtha fractions boiling in the range of from 30 to 220 °C, **one or more kerosene** fractions boiling in the range of from 120 to 300 °C and one or more **gasoil** fractions boiling in the range of from 170 to 370 °C. The term "hydrocarbon fuel" is to be taken as a reference to either one of or a mixture of naphtha and middle distillates.

In response to the prior art of record cited in the previous examiner's action and in support of the scope of the invention now presented in the amended claims, applicant argues the following:

Applicant already has explained why the examiner has not pointed to a teaching or Suggestion of every, limitation of the claims in the Cited references. Applicant will not repeat all of the relevant arguments here. To the extent that the examiner maintains the rejection, the examiner is contending that it would have been "obvious to try" using the claimed low density liquid F-T derived products to operate yellow flame burners. Whether or not the examiner can establish that it would have been obvious to try the Claimed process is a question of fact in order to meet his burden of proof, the examiner must establish that there was "a reasonable expectation of success." *Pfizer Inc. v. Apotex Inc.*, 82 U.S.P.Q.2d 1321. 1333-34 (Fed. Cir.2007).

In response to applicant's argument, the examiner affirms that the rationale to support a conclusion that the claim would have been obvious is that "a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely that product [was] not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103." *KSR*, 550 U.S. at ___, 82 USPQ2d at 1397. That is, the examiner must establish there was "a reasonable expectation of success".

With regard to a reasonable expectation of success of producing a low polluting combustion by substitution of a Fischer-Tropsch derived liquid fuel for a conventional, or non-Fischer-Tropsch derived fuel, the examiner maintains that the prior art clearly supports the conclusion of obviousness. More specifically, at the time of the invention a person having ordinary skill in the art would at least have had a reasonable expectation of success that Fischer-Tropsch derived fuels would suitably operate as alternative fuels according to the explicit teaching of **Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, *Ind. Eng. Chem. Res.* 1998, 37 2029-2038) which discloses burning light Fischer-Tropsch fuels or Syncrude (see page 2030, column 1, lines 27-36) in combustion apparatus such as internal combustion engines, as a suitable alternative to diesel and gasoline fuels (see page 2031, column 2, lines 4-35) in for example conventional diesel engines. **GB 2215032 A (Shin)** recognizes kerosene and Diesel fuels as interchangeable and suitable equivalent fuels for use in space heaters. **Shell Middle Distillate Process** clearly teaches that at the time of the invention a person having ordinary skill in the art would have known of the advantages of using Fischer-Tropsch derived fuels (Shell Middle Distillate Synthesis Process (SMDS)), or SMDS middle distillates

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from natural gas. **Shell Middle Distillate Process** expressly highlights that both kerosene and gas oil Fischer-Tropsch derived fuels have exceptional qualities (e.g. - free from impurities such as nitrogen and sulphur and from aromatic species a low environmental impact; excellent combustion properties-smoke point and cetane number-and show very low particle emissions.). **US004764266 (Chen et al)**, **US005807413 (Wittenbrink et al)** and **US006787022 (Berlowitz et al)** clearly establish to a person having ordinary skill in the art that Fischer-Tropsch derived fuel are known to have no additives and “nil” or less than 1 ppm nitrogen and sulfur and low aromatic content and a density similar to that of home heating fuels. With regard to the density of the Fischer-Tropsch product being lower than the conventional mineral derived fuels, applicant’s own disclosure acknowledges that “As a result of the low contents of aromatics and naphthenics compounds the density of the Fischer-Tropsch product will be lower than the conventional mineral derived fuels. The density will be between 0.65 and 0.8 g/cm³ at 15 °C.” **US003808802 (Tanasawa)** clearly teaches to a person having ordinary skill in the art that combustion systems used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines are known to operate with all kind of fuels such as a Fischer-Tropsch fuel and which generally meets product specifications for use as a light fuel oil, e.g. home heating oil, diesel and jet fuels, wherein the burner is capable of operating in a wide range of air-fuel ratio, or “lambda”. Furthermore, with regard to lambda and yellow flame combustion applicant’s own disclosure acknowledges that “The operating conditions of the yellow flame burner may be the same as the operating conditions used for the state of the art fuels. The proportion of air in excess of that required for stoichiometric combustion is known as the excess air ratio or "lambda", which is defined as the ratio of total air available for combustion to that required to burn all of the fuel. Preferably the lambda is between 1 and 2 and more preferably between 1 and 1.6. That is, at the time of the invention a person having ordinary skill in the art would understand that yellow flame combustion conventionally occurs under conditions where the proportion of air in excess of that required for stoichiometric combustion is known as the excess air ratio or "lambda", wherein lambda is between 1 and 2 and more preferably between 1 and 1.6. Finally, **US 20020020107 (Bailey et al)** and **EPA: Clean Alternative Fuels: Fischer-Tropsch** explicitly establish at the time of the invention that burning Fischer-Tropsch derived fuels would result in reduced emissions of particulate matter, nitrogen oxides and carbon monoxide lower than conventional

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fuels, in view of the teaching of **US 20020020107 (Bailey et al)** or **EPA: Clean Alternative Fuels: Fischer-Tropsch**. In view of the separate and combined teachings of the prior art, indeed the prior art as a whole, and for the reasons presented and discussed both herein above and in the following examiner's action, the examiner maintains that the prior art provides sufficient evidence in fact that a person having ordinary skill in the art at the time of the invention would have had a reasonable expectation of success in combining the prior art teachings to arrive at the claimed invention.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Accordingly, while applicant's arguments have been carefully considered, applicant's claims do not patentably distinguish applicant's invention over the prior art of record.

See the examiner's action herein below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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Claims **22-44**, are rejected under 35 U.S.C. 103(a) as being unpatentable over **Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038) in view of **US004764266 (Chen et al)**, **US005807413 (Wittenbrink et al)**, **US006787022 (Berlowitz et al)** and **US003808802 (Tanasawa)**, as further supported by **GB 2215032 A (Shin)**, **AIR RESOURCES BOARD CALIFORNIA DIESEL RISK REDUCTION**, (Appendix IV; Fuels Report: Appendix to the Diesel Risk Reduction Plan, Page IV-10) and **Shell Middle Distillate Process** (Eiler, J., Posthuma, S.A., Sie, S.T., Catalysis Letters, 1990, 7, 253-270), **US 20020020107 (Bailey et al)** and **EPS: Clean Alternative Fuels: Fischer-Tropsch**.

Suppes et al (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038) discloses burning light Fischer-Tropsch fuels or Syncrude (see page 2030, column 1, lines 27-36) in combustion apparatus such as internal combustion engines, as a suitable alternative to diesel and gasoline fuels (see page 2031, column 2, lines 4-35) in for example conventional diesel engines. Known light Fischer-Tropsch fuels disclosed by **Suppes et al** include the following properties:

- > 70% Fischer-Tropsch syncrude(see page 2031, column 2, lines 4-35), or 90% (by mass) of the light syncrude composition (see page 2029, column 2, lines 1-4);
- near-zero aromatic contents; and
- a boiling point of 170.6-314.9° C (Table 1).

US004764266 (Chen et al) teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, a process for using or burning middle distillate Fischer-Tropsch derived fuel having typically boiling in the 165 to 345.degree. C. (about 330.degree. to 650.degree. F.) with lesser proportions of naphtha as a "home heating oil" (see column 10, line 16-34). This middle distillate fraction is, however, relatively low in sulfur and generally meets product specifications for use as a light fuel oil, e.g. home heating oil, diesel and jet fuels. **US004764266 (Chen et al)** acknowledges the presence of non-mineral fractions, or additives, in the Fischer-Tropsch distillate (e.g. – unconverted fractions).

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US005807413 (Wittenbrink et al) teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, that fuels produced by the Fischer-Tropsch process have essentially nil sulfur and nitrogen. See also, for example, **US006787022 (Berlowitz et al)** which teaches Fischer-Tropsch fuel characterized by "1) paraffins at least 90 + wt %, preferably at least 95 + wt %, more preferable at least 99 + wt % sulfur .ltoreq.10 ppm (wt), preferably <5 ppm, most preferably < 1 ppm nitrogen .ltoreq.10 ppm (wt), preferably <5 ppm, most preferably < 1 ppm aromatics <1%, preferably <0.1% cetane number >65, preferably >70, more preferably >75"). **US006787022 (Berlowitz et al)** yields of distillate fuels with excellent cold flow properties are produced from wax containing paraffins derived from the Fischer-Tropsch process to produce a full boiling range diesel fuel, preferably a **320-700** degrees F (i.e. **160-371** degree C) fraction, with the unique combination of high cetane number, very low cloud and cold filter plugging point (CFPP) performance and full boiling range cut exhibiting **superior emissions performance.**

US005807413 (Wittenbrink et al) discloses:

(7) By virtue of using the **Fischer-Tropsch** process, the recovered distillate **has essentially nil sulfur and nitrogen**. These hereto-atom compounds are poisons for Fischer-Tropsch catalysts and are removed from the synthesis gas that is the feed for the Fischer-Tropsch process. (Sulfur and nitrogen containing compounds are, in any event, in exceedingly low concentrations in synthesis gas.) Further, **the process does not make aromatics**, or as usually operated, virtually **no aromatics** are produced. Some olefins are produced since one of the proposed pathways for the production of paraffins is through an olefinic intermediate. Nevertheless, olefin concentration is usually relatively low.

(19) Although the studies in the three SAE papers did not deliberately vary either the density or the distillation profile of the fuels, these properties, of necessity, were varied as a natural consequence of changing the fuel cetane number and aromatic content. The results of these studies were that particulate matter (PM) emissions were primarily affected by the cetane number, sulfur content, oxygen content and aromatic content of the fuels. However, **neither fuel density nor distillation profile had any effect on particulate matter (PM) emissions in these studies.**

(Highlighting and Underlining Added)

US003808802 (Tanasawa) teaches, from applicant's same liquid combustion fuel field of endeavor, that is known to operate combustors used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines, and operating under either "yellow

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flame” or “blue flame” conditions, with “all kind of fuels, such as gas fuel, gasoline, lamp oil, light oil, heavy oil and the like” and “can be equally burned in a wide range of air -fuel ratio”.

US003808802 (Tanasawa) discloses the following:

“(3) The present invention relates to a vortex combustor which can be used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines.”

“(4) 2. The Prior Art

“... moreover, a high intensity combustion is carried out in the combustion chamber of the vortex combustor, so that all kind of fuels, such as gas fuel, gasoline, lamp oil, light oil, heavy oil and the like, can be equally burned in a wide range of air -fuel ratio.”

“(5) In case of the various conventional combustors, because of their structure and severe operating condition, only in the narrow range of air -fuel ratio, the combustion efficiency and the combustion intensity (the weight of fuel which can be burned per unit time in the unit volume, or calorific value of the said fuel; kcal/m.sup.3 -hr-atm) can be kept high in some degree. In the case of such combustors designed for gas turbines and for jet engines, it is necessary to supply a large amount of air into the combustion chamber in proportion to its output. If this air flow increases, combustion flame does not spread to the whole inside wall of the combustion chamber, and the mixture of air and fuel is not burned with high intensity, so the combustion efficiency and the combustion intensity becomes low. While there have been many studies about vortex combustors, a satisfactory combustor for practical use has not yet been provided, mainly because of the fact that these studies haven't cleared up some of the important characteristics of vortex combustors.”

“(68) Since the fuel stays for a long period of time in the first and the second combustion chambers because of the swirling flow pattern, the combustion efficiency becomes as high as nearly 100 percent, whether the combustion condition in the combustion chamber is the yellow flame combustion or the blue flame combustion.”

“(86) The vortex combustor of the present invention can be applied to various combustors using heat energy for home use or industrial use, and various combustors for heat motors using mechanical energy converted from heat energy, besides gas turbine engines for automobiles and for aircraft, which are described herein with relation to the first and second embodiments. For example, they can be used as various combustors using heat energy, such a boilers, burners, steam motors, heating apparatus and water boilers. They can also be used as the combustors for heat motors using mechanical energy which is converted from heat energy, such as various steam turbines, gas turbines, jet engines and steam engines, which can be employed in many fields, for example, for aircraft, ships, motor vehicles, electric generation and for industrial motive force in various works.”

(Highlighting and Underlining Added)

US 20020020107 (Bailey et al) teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, that Fischer-Tropsch derived fuel can produce excellent fuel economy

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while **reducing emissions of particulate matter** and other toxic products, **nitrogen oxides**, **carbon monoxide** and other regulated gaseous emissions.

US 20020020107 (Bailey et al) teaches:

[0032] The hydrocarbon blends of the invention can be produced through direct Fischer-Tropsch processing or by conversion of Fischer-Tropsch products to create the desired ranges of components. Alternatively, the fuel compositions can be produced through petroleum crude oil distillation processing followed by isolation or subsequent processing to create the desired ranges of components.

[0033] The fuel compositions of the invention can be used as fuels for conventional diesel engines, advanced compression ignition engines and even fuel cells. The fuel compositions claimed under this invention can be used in current technology diesel engines which operate on a compression ignition principle. The fuel compositions claimed can also be used in new generation direct injection compression ignition engines including advanced control systems designed to take advantage of the fuel composition to meet current and future emission standards, or other compression ignition engines without direct injection. The fuel compositions claimed can also be used in fuel cell engines, provided an onboard or stationary reformer is used to generate hydrogen for fuel cell applications. Such engine-fuel combinations can be used to power a variety of applications, including, but not limited to, highway or off-road vehicles, aircraft, watercraft or stationary power plants. When used to fuel such engines, the fuel compositions of the invention can produce excellent fuel economy while **reducing emissions of particulate matter** and other toxic products, **nitrogen oxides**, **carbon monoxide** and other regulated gaseous emissions.

EPA: Clean Alternative Fuels: Fischer-Tropsch

Actual emissions will vary with engine design; these numbers reflect the potential reductions offered by Fischer-Tropsch liquids, relative to conventional diesel.

- Nitrogen oxide reductions due to the higher cetane number and even further reductions with the addition of catalysts.
- Little to no particulate emissions due to low sulfur and aromatic content.
- Expected reductions in hydrocarbon and carbon monoxide emissions.

* Estimates based on Fischer-Tropsch's inherently "cleaner" chemical properties with an engine that takes full advantage of these fuel properties.

In regard to claims **22-44**, for the purpose for providing an alternative fuel for conventional home heating systems, it would have been obvious to a person having ordinary skill in the art to operate home heating systems including burners fueled with Fischer-Tropsch fuel having no additives and "nil" or less than 1 ppm nitrogen and sulfur and low aromatic content and a density similar to that of home heating fuels (i.e. – between 0.65 and 0.8 g/cm³ at 15° C), in view of the teaching of the **US004764266 (Chen et al)** and **US005807413 (Wittenbrink et al)** and **US006787022 (Berlowitz et al)**. In addition, in view of the teaching of **US003808802**

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(**Tanasawa**), it would have been obvious to a person having ordinary skill in the art to operate combustion systems used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines with all kind of fuels such as a Fischer-Tropsch fuel and which generally meets product specifications for use as a light fuel oil, e.g. home heating oil, diesel and jet fuels, wherein the burner is capable of operating in a wide range of air-fuel ratio, or “lambda”.

Also, in regard to **claims 22-44**, it would have been obvious to a person having ordinary skill in the art that burning Fischer-Tropsch derived fuels would result in reduced emissions of particulate matter, nitrogen oxides and carbon monoxide lower than conventional fuels, in view of the teaching of **US 20020020107 (Bailey et al)** or **EPA: Clean Alternative Fuels: Fischer-Tropsch**.

With regard to matter related to reason why a person having ordinary skill in the art would look to Fischer-Tropsch derived fuels applicant's attention is directed to the following:

Shell Middle Distillate Process, Eiler, J., Posthuma, S.A., Sie, S.T., Catalysis Letters, 1990, 7, 253-270 (Hereinafter referred to as **Shell Middle Distillate Process**).

(Page 265; paragraph 5)

5. Product quality

The products of the **SMDS process are pure paraffins, free from impurities such as nitrogen and sulphur and from aromatic species**. Consequently, **both the kerosene and the gas oil have excellent combustion properties**-smoke point and cetane number-**and show very low particle emissions**. Their cold-flow character The **SMDS products** therefore **make excellent blending components** for **upgrading refinery fractions that would otherwise only be used in fuel oil**.

(Page 265; paragraph 5)

6. Environment

The production of **middle distillates from natural gas** has **a low environmental impact** (fig. 13). Off-gases from the different process units are used **inside the plant** for **utility generation**: for instance, to fire the SMR. **Flue gases leaving the plant** are **free of SOx** and **low in NOx** and **fulfil the stringent European specifications**.

As a general principle, process water and condensate should be re-used to minimize the discharge of waste water. The process based on partial oxidation of natural gas is, however, a net producer of water. Waste water leaving the plant would first be treated to an extent such that discharge would be permitted. In areas of water scarcity, though, this water may even be turned to advantage: for example, for irrigation purposes.

The spent catalyst will be recycled for recovery of the metallic components.

Finally, the **exceptional quality** of both the **kerosene** and **gas oil** manufactured via **SMDS** means that, **if used as transportation fuels**, their emission of harmful exhaust products would be very low.

Shell Middle Distillate Process clearly teaches that at the time of the invention a person having ordinary skill in the art would have known of the advantages of using Fischer-Tropsch derived fuels (Shell Middle Distillate Synthesis Process (SMDS)), or SMDS middle distillates from natural gas. **Shell Middle Distillate Process** expressly highlights that both kerosene and gas oil Fischer-Tropsch derived fuels have exceptional qualities (e.g. - free from impurities such as nitrogen and sulphur and from aromatic species a low environmental impact; excellent combustion properties-smoke point and cetane number-and show very low particle emissions.).

Furthermore, the examiner maintains that it is this widely established fact and appreciated by those skilled in art of burner operation and fuel fired heating that issues concerning safety as well as issues related environment pollution would have indeed been the motive for persons having ordinary skill in the art of combustion to select and or bring together already known techniques for mitigating unwanted environmental pollution, such as the solutions presented in the teachings of **Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038), **US004764266 (Chen et al)**, **US005807413 (Wittenbrink et al)**, **US006787022 (Berlowitz et al)** and **US003808802 (Tanasawa)**.

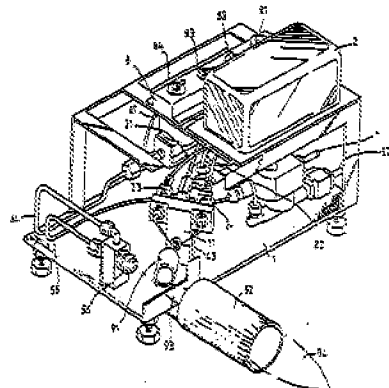
A person having ordinary skill in the art would have at the time of the invention readily appreciated the similarities between and readily substitute suitable alternative liquid fuels, such as kerosene and Diesel fuel, were there is a reasonable expectation of success, applicant's attention is directed to the new added prior art reference of **GB 2215032 A (Shin)** discussed and reproduced in part herein below. While acknowledging certain drawbacks of using high ignition point liquid fuels (i.e. - kerosene and Diesel fuel) in portable space heaters **GB 2215032 A (Shin)** nonetheless recognizes kerosene and Diesel fuels as interchangeable and suitable equivalent fuels for use in space heaters. **GB 2215032 A (Shin)** teaches that increased efficiency and lowered environmental pollutants result when applying suitable preheating and gasifying techniques to the combustion of ***kerosene and Diesel fuels***.

TITLE: PREHEATING-EXEMPT FUEL GASIFYING STOVE

This invention relates to a preheating-exempt
fuel gasifying stove, or burner.

It is found that most fuels for gasifying stoves are kerosene and Diesel fuel oil which are of high igniting point. Hence, in order to cause the fuel to be burned easily, it is commonly suggested to set a preheating procedure so that the fuel will be heated prior to its gasification thereby helping the combustion of the fuel. However, the temperature increased in such preheating procedure is often insufficient to cause a complete combustion, thus wasting fuel, lowering the efficiency as well as polluting the ^{environment} ~~circumstances~~. Furthermore, the gasifying stove is usually connected externally with a tank of gas for igniting the gasifying fuel. Whereas, the gas tank will occupy a lot of space, causing much inconvenience in installation.

It is, therefore, an object of the present invention to provide a preheating-exempt fuel gasifying stove which may obviate and mitigate the above-mentioned drawbacks.



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The underlying principle and concept of the present invention is directed to a process of combusting of a synthetic, manufactured or non-naturally occurring hydrocarbon fuel of the type derived from or by a Fischer-Tropsch process, and wherein this combustion takes place in a “yellow flame burner”. In this regard the examiner has presented the requisite and adequate information of fact to support the conclusion of obviousness. More precisely, in view of the teaching of US003808802 (Tanasawa), that combustors employed in many fields using heat energy (e. g. - boilers, burners, steam motors, heating apparatus and water boilers) operate generally using one of two types of combustion known as “yellow flame” combustion and “blue flame” combustion. A person having ordinary skill in the art at the time of applicant’s invention would have understood that the low sulfur, low nitrogen, low aromatic middle distillate (boiling in the range of 165.degree. to 345.degree. C. (about 330.degree. to 650.degree. F.)) fuels of **Suppes et al**, **US004764266 (Chen et al)**, **US005807413 (Wittenbrink et al)** and **US006787022 (Berlowitz et al)**, taught to be suitable fuels in many filed such as a “home heating oil, diesel and jet fuels”, would necessarily be combusted in at least a burner of either a

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yellow or blue flame type, since the purpose and intent, and indeed understood motive, of **Suppes et al, US004764266 (Chen et al), US005807413 (Wittenbrink et al)_and_US006787022 (Berlowitz et al)**, is to offer up to the person having ordinary skill in the art suitable alternative fuels who's purpose is to be consumed in combustion "heating" processes of many types, including "home heat" and "water boiler". Indeed, **US006787022 (Berlowitz et al)** expressly suggests that the properties of these Fischer-Tropsch derived fuels exhibit "**superior emissions performance**" and thereby providing a further motive for utilizing these fuels. Stated another way, applicant is merely attempting to claim the process of combustion already known fuels for their known purpose, and in a manner (producing a yellow flame) notoriously well known in the art, and indeed for the purpose of capitalizing on the known properties and advantages (e.g.- "superior emissions performance") designed into this (Fischer-Tropsch derived) fuels.

With regard to the claimed range of fuel density (i.e. – between 0.65 and 0.8 g/cm³ at 15° C), it is noted that Applicant's disclosure acknowledges that "As a result of the low contents of aromatics and naphthenics compounds the density of the Fischer-Tropsch product will be lower than the conventional mineral derived fuels. The density will be between 0.65 and 0.8 g/cm³ at 15 °C. In this regard, a person having ordinary skill in the art would know and understand that the density of the Fischer-Tropsch product will be lower than the conventional mineral derived fuels, if not an inherent property of kerosene and gasoils. Nonetheless, regarding Fischer-Tropsch derived fuel products, US005807413 (Wittenbrink et al) teaches that neither fuel density nor distillation profile had any effect on particulate matter (PM) emissions and particulate matter (PM) emissions were primarily affected by the cetane number, sulfur content, oxygen content and aromatic content of the fuels. Further in this regard applicant's disclosure also states that Fischer-Tropsch products will be optimised, wherein pricing of the total fuel will be balanced with the advantages of the present invention. Therefore, in view of the teaching of US005807413 (Wittenbrink et al) (i.e. – fuel density nor distillation profile had any effect on particulate matter (PM) emissions") and in view of design and production concerns such as those of product pricing, it would have been obvious to a person having ordinary skill in the art selection of Fischer-Tropsch derived fuel product densities be between 0.65 and 0.8 g/cm³ at 15 °C. are

merely a result of choice, absent the showing of any new of unexpected results produced therefrom over the prior art of record.

With regard to claimed range of the “lambda”, or the ratio of fuel and air quantities, the examiner maintains the position that claimed “lambda” values can be viewed as nothing more than merely a matter of choice in design and/or a result-effective variable. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In this regard applicant’s attention is further directed to **US006986255 (Smith et al)** which discloses that “Yellow flames are always indicative of fuel-rich flames...”.

In regard to claims **36** and **37**, **Official Notice** is taken that it is well known to use flame detectors with burners. Since the type of flame detector used to detect the burner flame, would necessarily depend on numerous design concerns such as the operational characteristics of a given burner and heating system installation and the type of oxidant being used, the use of a blue flame detector can be viewed as nothing more than merely a matter of choice in design absent the showing of any new or unexpected result produced therefrom over the prior art of record.

Conclusion

See the following prior art made of record previously cited on USPTO 892 and not relied upon which is considered pertinent to applicant's disclosure.

US006392108 (O'Rear) and **US 6800101 (O'Reilly et al)** discloses the following with regard to Fischer-Tropsch derived fuels:

US006392108 (O'Rear):

“**Fischer-Tropsch** chemistry is typically used to convert the syngas to a product stream that includes combustible fuel, among other products. These Fischer Tropsch products have very low levels of sulfur, nitrogen, aromatics and cycloparaffins. The Fischer Tropsch derived fuels are considered “**green fuels**” and are desirable as environmentally friendly.

US 6800101 (O'Reilly et al):

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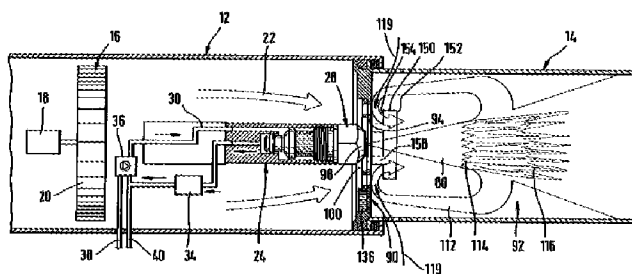
(83) **Distillate fuels**, derived from the **Fischer-Tropsch process**, have **excellent burning properties**. Fischer-Tropsch products contain **essentially no aromatics or heteroatoms**, such as **sulfur and nitrogen**. In addition, Fischer-Tropsch distillate fuels are **highly paraffinic**; paraffins are the majority components (**>50%**) **and can exceed 70% and even 95%**. As a class, **paraffins** are the **most biodegradable compounds found in petroleum** and are preferentially metabolized by microbes. Alkane oxygenases are the enzymes that initiate paraffin (i.e. alkane) degradation. **In contrast to Fischer-Tropsch products, conventional hydrocarbonaceous products contain many components, with paraffins being only a minority component.**

WO 9516882 A1 (KNAPP ET AL) discloses a blue-flame burner with optimized combustion characteristics.

ABSTRACT:

The invention concerns a liquid-fuel burner comprising a housing (10), a **precombustion** chamber (48) containing a nozzle assembly (24) with a nozzle (28) which produces a jet of fuel (80), a combustion chamber (92) in which the fuel jet broadens out, a partition (90) between the precombustion and combustion chambers, and a fan (16) designed to force a stream of combustion air into the combustion chamber, the fuel burning essentially stoichiometrically with a **blue flame**. In order to improve the burner to minimize the amounts of pollutants in the combustion gases, the invention proposes that, in addition to a stream of combustion air (102) entering the combustion chamber near the fuel jet, a second, recirculation-stabilizing stream of air (106) enters opposite the first stream, at a defined radial distance further out from the first stream. Inside the combustion chamber, an inner recirculation stream (112) is formed which is stabilized by the second stream of combustion air.

Fig. 10

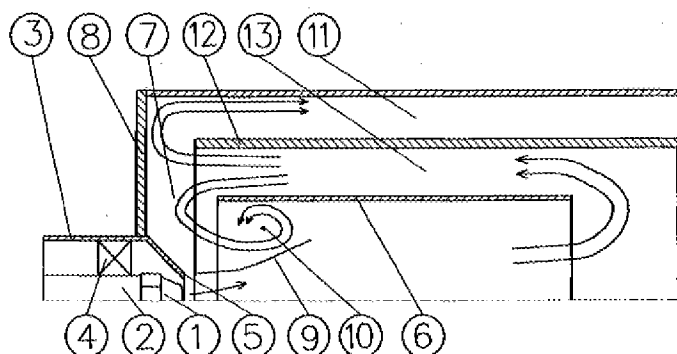


DE 19834051 A1 (KOEHNE et al)

ABSTRACT:

An improved design of burner for **liquid fuels** has the fuel and air mixture directed into a vaporizing chamber (6) coaxial inside the burn chamber (11) and with a return flow (13) between the two chambers. Part of the return flow, which has a **cold flame** effect, is ducted back into the **vaporizing chamber** to enhance the phase change of the fuel. The remainder of the **cold flame** effect mixture of **fuel vapour**, oxygen and other gasses passes into the burn chamber at a reduced start temperature for an improved burn without depositing cracking compounds anywhere in the system.

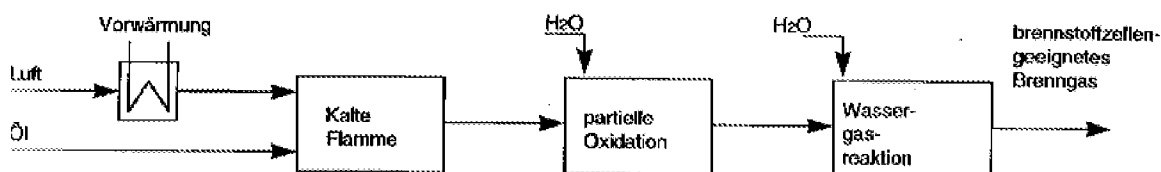
Fig. 3: Schnittdarstellung eines Brenners



DE19860308 (KOEHNE et al)

ABSTRACT:

Process for evaluating a fuel comprises contacting the fuel with an oxidizer in a reaction chamber and adjusting the residence time in the chamber with limited removal of heat. Process for evaluating a fuel comprises: (A) contacting the fuel with an oxidizer heated to 520-880 K or at low pressure with a reduction of temperature and a molar ratio C/O of 1: 0.14-0.25 in a reaction chamber, in which exothermic prereactions are initiated in a **cold flame** that effects **only a partial conversion of the fuel** and the oxidizer on homogenous mixing of the fuel and oxidizer; and (b) adjusting the residence time t_v of the mixture produced in step (a) in the reaction chamber t_v 25 ms at p not more than 1 with limited removal of heat from the reaction zone via an inert gas flow and/or the reaction chamber wall resulting in kinetic inhibition of the further reaction of the oxidizable mixture obtained by the cold flame.



US006787022 (Berlowitz et al) disclose:

(1) paraffins at least 90 + wt %, preferably at least 95 + wt %, **more preferable at least 99 + wt % sulfur** .ltoreq.10 ppm (wt), preferably <5 ppm, **most preferably < 1 ppm nitrogen** .ltoreq.10 ppm (wt), preferably <5 ppm, **most preferably < 1 ppm aromatics** <1%, **preferably <0.1%** cetane number >65, preferably >70, more preferably >75.

(Highlighting and Underlining Added)

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US004111642 (Kopp) discloses:

“(8) If the burner of FIG. 2 is to be started up, switchover device 17' is moved in the direction of arrow 34, and tubular member 31 acting as a shield closes long slits 30 so that the combustion air can be guided in the direction of arrow 36 between the two air feed pipes 22 and 23. When the mixture-distributor 10 is sufficiently heated, switchover device 17' will be shifted in the direction of arrow 33 coaxially to the burner feed pipe, and then funnel 32 of tubular piece 31 will abut neck 35, thereby blocking off annular passage 29 so that the combustion air will now be guided in the direction of arrow 37 via air feed pipe 22. Immediately thereafter the flame, which previously burned yellow, will burn blue.”

(Highlighting and Underlining Added)

US004302180 (Le Mer) discloses:

8) According to another known burner principle, the liquid fuel is gasified, for example in a pot, and then burnt, mixed with air, in the form of yellow flame, sometimes blue, according to the method adopted. This form of combustion has the drawback of being difficult to control, according to the draft of the chimney, and generally necessitates an excess of air, which reduces the yield.

(Highlighting and Underlining Added)

US004629414 (Buschulte) discloses:

This invention applies to many various oil or gas burners and is explained below based on an exemplary Bunsen type burner, i.e. a burner in which oil is burned completely with blue flame. The invention is not, however, limited to such burner type. The desired noise reduction may be obtained using the features defined herein, also in the case of, for instance, preheating burners or torches and yellow-flame burners.

(Highlighting and Underlining Added)

DE004323300A1 (English Language Abstract) discloses:

The device includes an air-guiding member (1) which is arranged in front of a burner nozzle (4) in order to generate a first airflow for recirculation and a second airflow for mixture preparation. The air-guiding member (1) has swirl elements (11, 15) in order to divide the airstreams into partial airstreams (13, 17) and, with simultaneous or subsequent deflection, direct them tangentially or radially to the fuel. The device can be used in burners with blue or yellow burner flame

USE/ADVANTAGE - Mixing device in burner produces blue and/or yellow flames in the burner and to reduce effectively the production of NOx.

(Highlighting and Underlining Added)

US004090854 (Davis) discloses:

The normally liquid fuel compositions of this invention normally are based on fuels derived from petroleum sources, e.g., normally liquid petroleum distillate fuels, though they may include those produced synthetically by the Fischer-Tropsch and related processes, the processing of organic waste

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material or the processing of coal, lignite or shale rock. **Such fuel compositions have varying boiling ranges, viscosities, cloud and pour points, etc., according to their end use as is well known to those of skill in the art.** Among such fuels are those commonly known as motor and aviation gasoline, diesel fuels, **jet engine fuel**, kerosene, distillate fuels, **heating oils**, **residual fuels**, bunker fuels, etc. The properties of such fuels are well known to skilled artisans as illustrated, for example, by ASTM Specifications D #396-73 (Fuel Oils) and D #439-73 (Gasolines) available from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa., 19103. Fuels containing non-hydrocarbonaceous materials such as alcohols (e.g., **methanol**).

US005378348 (Davis et al) discloses:

A flame burner comprising: burning a **Fischer-Tropsch** derived fuel which “boils”, or has a boiling point, between 160 degrees C and 400 degrees C (320°/500° F: i.e. - 160°/260° C) in the burner of a jet engine (see column 1, lines 41-64) when used as a jet fuel to obtain flue gases and a flame. With regard to claim 5, when used in the burner of a jet engine the space about the exit of the engine is necessarily heated, therefore **US005378348 (Davis et al)** meets the broadly stated limitation of “**heating a space** directly with the flue gases”.

It is well known to provide liquid fuels with odor or aroma (see for example US001944175) and color markers (See for example US005560855), and yellow flame coloring additives, for the purpose of aiding in readily identifying the fuel, and for aiding in making the flame visible (see for example US2002/0090585 or US006488726). Thus, in view of that which is well known in the art and for the known purpose, it would have been obvious to a person having ordinary skill in the art to modify the **Suppes et al** fuel to include odor and color markers.

THIS ACTION IS MADE FINAL

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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USPTO Customer Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carl D. Price whose telephone number is (571) 272-4880. The examiner can normally be reached on Monday through Friday between 9:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven B. McAllister can be reached on (571) 272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CARL D. PRICE/

Primary Examiner, Art Unit 3749